

CSci 126 Midterm I

Fall 2002

Name

There are three parts: relational algebra, SQL DDL, and logical database design.

There are 10 problems and three pages.

20 points

The following database applies to Part I and Part II:

Emp(eid: integer, ename: string, age: integer, salary: real)

Works(eid: integer, did: integer, pct_time: integer)

Dept(did: integer, dname: string, budget: real, managerid: integer)

Part I Give an expression in **relational algebra** for each of the queries for problems 1 & 2. (2 points each)

Problem 1 Find the names of *Emp* whose age is over 62.

Problem 2 Find the name of the manager who manages Dept 101.

Part II SQL DDL

Problem 3 Write the SQL statement required to create the relation *Emp*.

Problem 4 Define the *Dept* relation in SQL so that every department is guaranteed to have a manager.

Company Database

The company is organized into departments. A department is described by its Name, Number and Locations. A department may have several locations. No two departments have the same name or number.

A department controls a number of projects. A project is described by its Name, Number and a single Location. No two projects can have the same name or number.

Employees are described by SSN (for social security number), Name, Address, Bdate (for birthday), Salary, and Sex. We keep track of the individual components of Name: FName (for first name), MI (for middle initial), and LName (for last name). No two employees have the same SSN value.

We want to keep track of the dependents of each employee (for insurance purpose). We keep each dependents Name, Sex, and Bdate (for birthdate).

A department is related to exactly one employee who manages the department. We keep track of the StartDate when that employee started managing the department. An employee may manage at most one department.

A department is related to a number of employees who work for (work_for) the department. Each employee may works for exactly one department.

A department can also be related to a number of projects that are under its control. A project is controlled by exactly one department.

Each employee can work on (work_on) several projects. A project has several employees working on it. We keep track of the Hours that the employee works on the project.

Supervision is a relationship between employee (in the supervisor role) and employee (in the supervisee role). An employee may have one direct supervisor and several direct supervisees.

Each employee may have zero or more dependents. Each dependent is related to (dependent-of) one employee.

The following problems apply to the Company Database.

Problem 5

Give an entity-relationship diagram for the database, and indicate the constraints that are likely to exist on the relationships. Please use the convention we discussed in class. (4 points)

Problem 6 Please list the primary keys for the following: (0.5 point)

work_on
dependent

Problem 7 Please list the mapping constraints for the following relationships: (0.5 point)

work_on
dependent-of

Problem 8 Reduce the ER-diagram to tables for the following entities and/or relationships: (2.5 points)

- (i) **employee** (1 point)
- (ii) **dependent** (0.5 point)
- (iii) *manages* (0.5 point)
- (iv) *supervision* (0.5 point)

Problem 9

Translate the ER diagram into a data-structure diagram using Chen's technique (3 points).

Problem 10

Design the record format using a chain and pointers implementation following Chen's technique for the following: (2 points)

- (i) **department**
- (ii) **employee**